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Preface

Epigenetics

Epigenetics as coined by the British biologist Conrad Waddington to explain differentiation [1] deals with alterations in gene expression unrelated to changes in DNA sequences. Although not based on DNA mutations, epigenetic changes are clonally inheritable from one cell to the other, potentially modified by environmental stimuli and even transmitted from parent to offspring in some instances. Epigenetic processes play an important role in the earliest stages of development when epigenetic modifications of chromatin structure, such as DNA methylation, cause lifelong and sometimes trans-generational traits [2]. Besides DNA methylation, specific epigenetic mechanisms among others comprise histone modifications (e.g. by Polycomb–Trithorax protein complexes), ATP-dependent chromatin remodeling and non-coding RNA-mediated gene-silencing. Most of these epigenetic processes have an impact on chromatin organization and maintenance, and occur in many species affecting important biological processes such as genomic imprinting, X-inactivation, reprogramming in embryogenesis, and chromosomal structures. The past few years have seen an explosion of knowledge in the molecular mechanisms of epigenetics, along with the realization that epigenetic processes could also result in phenotypic variation [3]. Given that diseases are phenotypes, it is not surprising that impaired epigenetic processes are a major fundamental risk in acquired disorders such as cancer and thus epigenetic drug-based chemotherapeutic approaches are subjects of intense research [4].

The present Special Issue on EPIGENETICS comprises 16 reviews covering the topics of *DNA methylation* [5–7], *histone modification and chromatin regulation* [8,9], *environmental epigenetics* [10–12], *developmental plasticity* [13,14], *cancer epigenetics* [15–18] and *epigenetics and therapeutic potential* [19,20]. The editors thank the authors and reviewers for their efforts and hope that the readers will enjoy this updated, comprehensive and foresighted discussion on ongoing epigenetic research.

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Jean-Pierre Issa
Department of Leukemia, The University of Texas, MD Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, TX 77030, USA
E-mail address: jissa@mdanderson.org

Wilhelm Just
Biochemie-Zentrum der Universität Heidelberg (BZH), Im Neuenheimer Feld 328, D-69120 Heidelberg, Germany
E-mail addresses: wilhelm.just@bzh.uni-heidelberg.de

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